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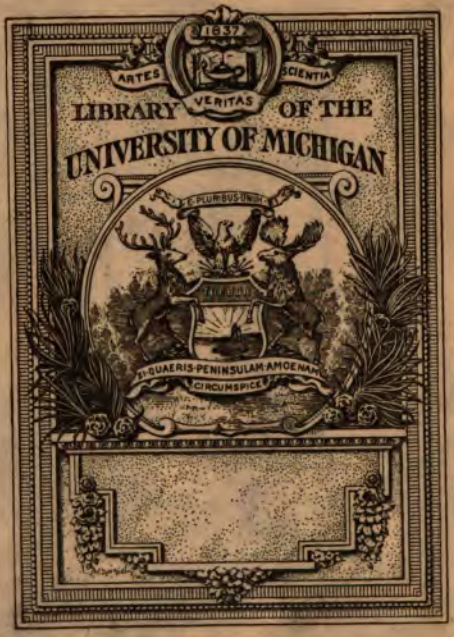
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TESTIMONY ON

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THE CLAYS

—AND—

Sattler Paving Brick,

GIVEN IN THE CONDEMNATION OF THE

MEINTS TRACT,

BY THE CITY OF ST. LOUIS FOR ITS

NEW CONDUIT IN NORTH ST. LOUIS,

Before Special Commissioners appointed by the St. Louis Circuit Court, 1888—1889.

ST. LOUIS.
WEISS & MACCALLUM, PR., 3741-43 NORTH BROADWAY.
1889.

PREFACE.

———:o:———

THE following testimony is extracted from that portion of the proceedings before the Special Commissioners, appointed by the St. Louis Circuit Court No. 3, case No. 78801, to condemn the Albert M. Meints tract, that bears directly on the clays that are found underlying said lands, and the Sattler paving brick made therefrom.

A strip about 945 feet long by 60 feet wide was desired by the City, along the East side of the Columbia Bottom Road, on which to construct the conduit required for the new Chain of Rocks system of water-works, and the subsequent testimony was part of the evidence presented to the Commissioners to enable them to arrive at the value of the strip of land desired by the City.

The Commissioners consisted of:

PROF. WM. B. POTTER, Chairman,
LEWIS ROSENBAUM, Secretary,
JOHN C. LULLMANN.

Chas. C. Broadhead was counsel for the plaintiff, and Daniel T. Jewett for the defence. Sittings extending from Oct. 31, 1888 to May 1, 1889 were held, at which various witnesses were examined in reference to the value of the land in that neighborhood for farming, clay-mining, and other purposes, and the subsequent testimony is selected from that portion of the evidence which bears directly on the clays and the paving bricks made therefrom, as given by competent experts.

Though the Commissioners decided that the owner was only entitled to the nominal value of $500 per acre, as they said that only its present market value, for the purpose for

which it was used, could be entertained, they acknowleged the high value of the property for its underlying clays; but as the utilization of these clays was a matter of the future, as no clay had thus far been mined from the strip under their consideration, it would be beyond their jurisdiction to consider values that depended on future developments.

Their report, stripped of descriptions and other preliminaries, is given hereafter.

Stars indicate the omission of testimony that related to personal matters before the Commissioners, but which was of no interest or had any bearing to the matter hereinafter reproduced.

201633

TESTIMONY OF PROF. H. A. WHEELER.

Consulting Mining Engineer.

TESTIFIED that he is a mining engineer.

That he had visited and examined the Meints land desired by the City of St. Louis for its new conduit.

That four test pits had been sunk on said strip of land, on a line parallel with and about 20 feet East of the Columbia Bottom Road at the following distances from the South line of said strip :

No. 1.....157 feet.
No. 2.....373 "
No. 3.....678 "
No. 4.....828 "
(North Boundary...948 ")

That he had carefully examined and sampled each of these pits.

That No. 1 Pit had only been sunk through the top clays to the "paving-brick" or fire clay, which was found in place, under an 18-inch seam of good bituminous coal, at a depth of 17 feet.

That No. 2 Pit was 34 feet deep and 4 by 4 feet in size; that there was 22 feet of "paving-brick" or fire clay in the lower part of the pit, over which is 7.5 feet of mixed yellow and fire-clay, suitable for sewer pipe, and on top was 7.5 feet of common red-brick clay.

That No. 3 Pit was 32 feet deep and 4 feet diameter; that there was two feet of the very best grade of fire-clay or "pot clay" at the bottom; over which was 11.5 feet of "paving-brick" or fire-clay, above which was 4 feet of "sewer-pipe" clay, and on top 12 feet of common red-brick clay.

That No. 4 Pit was 16.5 feet deep, having only been sunk to the top of the "paving-brick" or fire-clay, which was found in place; that the "sewer pipe clay" resting on the "paving-brick" clay was 8 feet thick and topped with 6 feet of common red-brick clay.

Testified that the "paving brick" clay contained on an average about 3 feet of a purer clay, which by washing will make a pot clay.

Also that there is a strata of boulders from 1.5 to 2 feet thick in the paving brick clay, which will have to be picked out in working the deposit.

That an average thickness of the clays on the 60 ft. strip, as shown by the above four test-pits, would be:

KIND:	AVERAGE THICKNESS:
Pot Clay	1 foot.
Wash Pot Clay	3 feet.
Paving Brick Clay	13 "
Sewer Pipe Clay	7.5 "
Common Red Brick Clay	10.0 "
Total	34.5 feet.

THE POT CLAY.

TESTIFIED that the pot clay was of a very high quality for this class of especially high-grade fire clay, and showed burned and raw samples of same for direct comparison with samples of the famous imported Coblenz (German) pot clay, in which the comparison was very favorable. Also produced a letter from Thos. Coffin & Co., of Pittsburg, an extensive and long established glass-pot manufacturing concern, who had made a glass-pot from this clay which they stated had stood very well, lasting ten weeks in the glass furnace; the clay from which this pot was made had come from the Meints land on the West side of the Columbia Bottom Road, but which strong geological evidence indicated was identical with the pot clay on the East side of the road.

That the market value of such pot clay at present is $12 to $14 a ton, and as the cost of mining should not exceed $5.00 a ton (see estimate on page 17) with the very favorable conditions for working it by open pits on the East side (after the upper clays have been removed), the net profit per ton in working it should be over $5.00 a ton.

THE WASH POT CLAY.

TESTIFIED to the high quality of the wash pot clay made by washing a sample of 14 pounds taken from the 3 feet of the thick bed of fire clay, which contained less iron, in the form of minute crystals of pyrites or "shiners", than the rest of the bed. Analysis of the crude clay, before washing, and of the washed clay was given, to show the improvement effected by the washing, in lowering the amount of impurities present in the clay.

ANALYSIS OF THE WASH POT CLAY.

	CRUDE CLAY.	WASHED CLAY.
Silica	53.54	
Alumina	28.21	
Water (combined)	13.26	
Total of Essential Constituents	95.01	
Iron	2.80	2.30
Lime	1.01	0.47
Magnesia	0.11	0.06
Alkalies	0.76	0.66
Total of Impurities	4.68	3.49
Grand Total of all Constituents	99.69	

Stated that the washed clay had all passed through an 80-mesh seive (with 6400 holes to the square inch), and that the crude clay yielded 85 per cent. of this very fine wash clay, as washed by the usual process in purifying clays. Burned Samples of the washed clay showed that the iron, which was its principle impurity, was very finely and uniformly disseminated through the clay, and therefore in a condition to do no harm, while this impurity was the least deleterious of the usual impurities in fire clays. Also, that the wash pot clay made from the Meints land was superior to many of the pot clays in use, being purer and more reliable, and quoted analysis of several pot clays from different authorities for direct comparison.

ANALYSES OF POT CLAYS.

Constituents	I	II	III	IV	V	VI	VII	VIII	IX	X	
Silica		55.06	59.60	64.32	47.33	63.10	47.12	55.40	57.31	45.73	Non-Injurious Constituents.
Alumina		30.02	26.41	22.82	35.02	23.70	34.10	26.40	26.58	34.14	
Water		10.54	10.48	10.26	10.51	10.73	12.35	12.00	10.78	14.62	
Total of Essential Constituents		95.62	96.49	97.40	92.89	97.53	93.57	93.80	94.67	94.49	
Iron (Fe)	2.30	1.10	1.13	1.23	1.61	1.54	1.74	2.94	2.20	1.89	Injurious Constituents.
Lime	0.47	2.20	1.00	0.45	0.16	0.09	?	?	0.71	0.79	
Magnesia	0.06	0.41	0.07	0.12	1.11	0.06	0.39	?	0.49	0.74	
Alkalies	0.66	?	0.45	0.77	3.18	0.12	1.91	?	0.44	0.45	
Total of Foreign Constituents	3.49	3.71	2.65	2.57	6.06	1.81	4.04	*2.94	3.84	3.87	
Grand Total of all Constituents		99.33	99.14	99.97	98.95	99.34	97.61	96.74	98.57	98.36	

I. Meints 80 Mesh Wash Pot Clay.

II. Washed Clay, Dixon, Mo. U. S. Census Report, 1880, Vol. II, p. 40.

III. Washed Clay, Cheltenham, Mo. " " " "

IV. Crude Clay, Oak Hill, Mo. " " " "

V. German Crude Clay, Grundstadt, Germany, U. S. Census Report, 1880, Vol. II, p. 40.

VI. Crude Clay, Christy's Mine, Oak Hill, Mo. This is one of the best and purest pot clays known. U. S. Census Report 1880, Vol. II, P. 40.

VII. Washed Clay, Hohessin, Del. Report on Clays, N. J. Geol. Survey, 1878, p. 300.

VIII. Crude Clay, La Bouchade, France. Percy's Metallurgy, Vol. I, 1875, p. 101.

IX. Crude Clay, Congreaves, Stourbridge, England, " " "

X. Crude Clay; Edgemont, Sheffield, England, " " "

* This clay undoubtedly contains decided amounts of lime, magnesia and alkalies that have not been determined.

That while clays No. II, VII and VIII of the table (given on page 7) contained more impurities than as quoted, as their analyses were incomplete, especially No. VIII, and though Clay No. VI (Christy's) was one of the very purest pot clays known, yet the average amount of the impurities of these 9 other clays was slightly greater than No. I or the Meints wash pot clay.

Testified that the market value at present for wash pot clay was about $16.00 a ton, and that the expenses incurred in mining and washing it (see estimate on page 18), with the cheap facilities for working it by open pits, as exist on the East side of the Columbia Bottom Road, should not exceed $12.59 a ton, leaving a net profit of over $3.00 a ton on this grade of clay.

THE PAVING BRICK CLAY.

TESTIFIED that the paving brick clay made an exceptionally high quality of paving brick that was eminently adapted for street paving. That the paving brick made from this clay possessed great strength and hardness, and was porous, or not glazed. That the great strength of the paving bricks was due to the high density of the clay, and to the fact that the bricks were made from a pure, simple, unmixed clay. That the density or specific gravity of this clay was remarkably high, it being one of the densest clays known, it having an average density of 2.30 (water being 1.00 or the standard), while the average of 54 well known fire clays was 1.846, as given below:

DENSITY OF FIRE CLAYS.*

I. Average of 18 Fire Clays, from N. Raritan River, N. J., ranging from...1.53 to 2.17.... 1.83

II. Average of 15 Fire Clays, from S. Raritan River, N. J., ranging from...1.54 to 1.88.... 1.72

* From "Report on Clays," New Jersey Geological Survey, 1878, excepting VIII., which is by Prof. Wheeler.

DENSITY OF FIRE CLAYS, Cont'd.

III. Average of 13 other New Jersey Fire Clays, ranging from ..... 1.52 to 2.15 .... 1.89
IV. Cheltenham, Mo., Fire Clay, ranging from ..... 1.70 to 1.72 .... 1.71
V. Evans Mine, Mo., Fire Clay, ranging from ..... 1.76 to 1.79 .... 1.78
VI. Coblenz (Germany) Pot Clay (very high grade), ranging from ..... 2.23 to 2.77 .... 2.25
VII. Stourbridge (England) Pot Clay (very high grade), ranging from .. 2.43 to 2.55 .... 2.49
VIII. Meints' Fire Clay ("Paving Brick"), ranging from ..... 2.24 to 2.33 .... †2.30

This very high density was due to the natural fineness of the clay, as shown by the fact that 85 per cent. of it will pass through a sieve with 6400 holes to the square inch, after "slacking it" with water, whereas hardly as high a percentage of the Cheltenham fire clay will pass a sieve with only 1600 holes to the square inch. That the great hardness of the brick was due to the high heat at which the bricks were made, and to the fine grain of the clay. That the bricks were harder than granite, being from 6.5 to 7.0 on the Von Kobells scale of hardness (in which all substances range from 6 to 10, the diamond, the hardest thing known, being 10.0), while granite ranged from 5.5 to 7.0 and limestone (such as is used for street paving in St. Louis) from 3.0 to 3.5 on this same scale. That the porosity of the brick was due to the good grade of the fire clay, which permitted burning the bricks under a high heat without vitrifying them, and consequently that the bricks would keep rough under usage and give the horses a good foot-hold, while vitrified bricks would polish and become slippery.

Testified that the great thickness of the fire clay and its remarkable fineness were probably due to the fact that the

† The average of five determinations gave 2.30.

Meint's land lies in a geological basin in the Sub-Carboniferous limestone, which not only permitted a great accumulation, but was especially favorable for the deposition of very fine sediments. That the exceptional thickness of the fire clay (as compared with other clay-beds in the St. Louis region) was not due to a slide from the adjacent hill, as suggested by another witness, as the stratification and the overlying coal seam showed that it was in place, undisturbed.

Testified that the brick for street paving, when 4 inches wide by 5 inches deep by 9 inches long, could be made for $8.00 per superficial square (10 feet by 10 feet), which called for 400 such sized brick, or for $20.00 per 1000. That they could be hauled down to the City Hall from the Meint's property for $3.50 per square, and could be delivered at a profit in the city for $12.00 per square. That the cost of making Sattler street paving brick was about the same as making fire brick or somewhat less.

Testified that he had made several street paving brick from clay samples that he took himself from pits Nos. 2 and 3 on the East side of the road, which after burning showed a good fine grain, uniform structure and were free from shrinkage cracks; and that these brick were as good as those in use at the Missouri Pacific Railroad depot on Seventh street, which had been seven years under hard service. Testified that Mr. George Sattler had so perfected his method of making street paving brick, by first calcining the clay and partially removing some of the chemically combined water (which amounted to over 13 per cent), that he can now safely make a homogeneous brick of pure, unmixed clay without its cracking in drying or burning. That this preliminary calcining of the clay, before moulding it into brick, had only been recently discovered as preventing the cracking in drying and burning, which had previously caused so many failures in Sattler's early experiments. That to incorporate

calcined or burnt material into raw clay, as is done with ordinary fire clay ware, to prevent excessive shrinkage and cracking, would injure the strength and hardness of the brick, as the strongest brick should be made of a pure, simple clay. That until this discovery of calcining the clay had been made by Mr. Sattler, the value of the paving brick for paving brick purposes was questionable; but that now a uniform, reliable product could be made without any more uncertainty than in the ordinary manufacture of fire brick. That this calcining could be easily effected in mechanical furnaces at an expense of probably less than 50 cents a ton; that $1.00 a ton would be an excessive cost for the calcining.

Testified that he regarded the market value of this paving brick clay, on account of the very superior quality of street paving brick that could be made from it, as being worth 25 cents a ton on a simple royalty basis or net profit to the land-owner, though ordinary, coarse-grained fire clays sold elsewhere in the St. Louis district for a much smaller royalty.

THE SEWER PIPE CLAY.

TESTIFIED that the sewer pipe clay would answer very well for making sewer pipe, drain tiles, terra cotta, (the latter with some selection), as while it was too impure to make a fire brick or be used for refractory material, it would make strong earthen pipe ware, for which there was a large demand and of which great quantities are made in St. Louis. That the royalty value of the clay for this purpose was about 10 cents a ton.

THE COMMON RED BRICK CLAY.

TESTIFIED that the ten feet of overlying top clay would make a good common red brick for building purposes. That he had made some small bricks to show the color and

strength of the clay; that the color was a pleasing light red shade, and that the bricks were very strong. That to answer the objection of an opposing witness, who had stated that the brick would disintegrate under the action of frost, he had made Brard's standard frost test on 3 of them.

That Brard's frost test consisted in boiling the brick for one-half hour in a saturated solution of sulphate of soda, and then allowing the brick to cool, by which the sulphate of soda cystallizes out in the brick and gives the same disrupting action as freezing water. That under the high temperature (from the boiling) the pores of the brick are opened up much more than naturally, and the solution permeates the brick more thoroughly than water does in actual service, so that the action is far more severe than simple freezing, especially as the sulphate of soda usually has an injurious weakening chemical action on the specimen.

That while this was a standard test amongst engineers, architects, etc., it was recognized as being unnaturally severe on the specimen being tested. That while the standard number of times to which the specimen was subjected to the boiling and crystallizing action, was 8 times, that he had exposed the bricks 10 times to such action. That the loss sustained by the bricks, or the amount of material torn off by the crystallizing action of the sulphate of soda, was 0.12 per cent, which was a remarkably small loss, and spoke highly of the great strength of the brick. He cited similar tests made by Prof. John C. Draper, in New York, where the New York red brick under 8 tests lost 0.74 per cent. and white brick, 0.24 per cent.; but that the St. Louis clays, as a general rule, made exceptionally strong brick, so that the Meints clay would not be superior to brick made from other St. Louis clays.

Testified that the royalty value of common red brick clays was about 2.5 cents per cubic yard.

* * * * *

PROF. WHEELER submitted estimates for the cost of making Sattler paving brick, with a plant of 10,000 daily capacity, including the cost of erecting such a plant on the bottom lands of the Meints tract. He also gave estimates of the cost of mining the pot clay, and of the wash pot clay, which are herewith appended.

COST OF MAKING SATTLER PAVING BRICK,

with a $45,000 plant of 10,000 bricks capacity.

ONE MONTH'S ESTIMATE.

Labor—(see below for details)		$1,995.00
Coal—For Burning 2250 tons brick at 5 bus.	11,250	
For Calcining 2250 tons clay at ½ bus.	1,125	
For 2 Boilers, 26 days, at 150 bus.	3.900	
Total Coal required	16,275 bus.	
16,275 bus. at 8 cents*		$1,302.00
Oil, Packing and Waste		50.00
Repairs and Renewals		250.00
Carrying $15,000 Insurance at 2 pr. ct. (see below)		50.00
Interest on $45,000 invested capital, at 6 pr. ct.		225.00
Interest on $30,000 working capital, at 8 per cent, (Borrowed)		200.00
Taxes		50.00
Incidentals		150.00
Mining 2250 tons clay, by open pits, at 30 c. (60 cents per cubic yard)		675.00
Hauling 2250 tons clay, at 10 c. (to the factory)		225.00
Total operating expenses, per month		$5,172.00
One months product, at 10,000 per day, 26 days		260,000

*Coal was mined on the Sattler land at 6 cents a bushel for labor.

Then $5,172 ÷ 260=$19.88 per 1000 brick, or as 400 brick make a square=$7.95 per square as the complete cost of manufacturing 9x4x5 Sattler paving bricks.

The Labor Account is made up a follows, per month:

1 Engineer	$ 75.00
1 Fireman	52.00
2 Clay Grinders, at $39.00	78.00
3 Wheelers to Pan, at $32.50	97.50
2 Brick-Machine Hands, at $52.00	104.00
3 Brick-Machine Feeders, at $32.50	97.50
4 Offbearer, at $32.50	130.00
2 Packers, at $32.50	65.00
1 Boss Kiln-Setter	60.00
2 Assistant Kiln-Setters, at $45.50	91.00
2 Pitchers, at $32.50	65.00
5 Brick Wheelers, at $39.00	195.00
1 Boss Burner	60.00
6 Assistant Burners, at $50.00	300.00
6 Laborers, at $32.50	195.00
1 Watchman	45.00
1 General Mechanic	75.00
1 Clerk	60.00
1 Superintendent	150.00
Total Labor	$1,995.00

(Signed.) H. A. WHEELER,
Mining Engineer.

St. Louis, February 27, 1889.

COST OF PLANT

of 10,000 Bricks Daily Capacity.

The factory is to be 280x70 feet, 2 stories or 24 feet high, to be built of brick, with walls 18 inches thick on 1st floor, 9 inches on 2nd floor, and to have 24x9 buttresses every 14 feet.

Masonry—

294 M. Brick, at 21 brick per cubic foot, at $11.50 laid	$ 3,381.00	
336 Perches Rock foundation for main walls, 6 ft. deep by 2 ft. wide, at $3.20 laid	1,075.20	
270 Perches Rock foundation for sills 3 ft. deep by 2 ft. wide, at $3.20 laid	864.00	
Digging 900 cubic yards trenches, for foundation, at 20 cts	180.00	
Grading, say 1200 cubic yards, at 10 cents	120.00	
Total masonry		$ 5,620.20

Wood Work—

58,800 ft. B. M. Floor Beams, 3x12, spaced 12 in. bet. centres.
39,200 ft. Rafters, 2x12.
33,600 ft. Sill Timbers, 12x12, and 6x12.
35,000 ft. Posts, 12x12.
49,000 ft. Flooring, 2 in., on all of 2nd and half of 1st floor.
19,000 feet Roofing, 1 inch.
13,900 feet Incidentals.

Amount carried forward $5,620.20

Amount brought forward.....		$5,620.20
Total 250,000 ft. Lumber, at $18.00...	$4,500.00	
90 Sashes, glazed and painted, 4x8 feet, at $7.00.....	$630.00	
4 Doors, 10x10, at $11.00.....	44.00	
10 Doors, 6x8, at $8.00	80.00	
4 Doors, 4x8, at $4.00	16.00	
	$ 770.00	
Nails, Hardware and Iron Work....	300.00	
Carpenter Work (labor).....	1,500.00	
200 Squares of Gravel and Tar Roofing at $4.00 laid.....	800.00	
Total Wood Work.....		$7,870.00
Machinery—		
1 No. 4 Penfield Brick-Machine, complete.....	$1,300.00	
1 Heavy Pug-Mill.....	550.00	
2 Grinding Pans, at $1,000.00.....	2,000.00	
1 Revolving Screen, complete.....	500.00	
1 Engine, 18x30.....	1,500.00	
2 Boilers, at $1,000.00, complete.....	2,000,00	
3 Tanks, at $250.00.....	750.00	
2 Pumps and Pipe Connections.....	1,000.00	
Steam Piping (for steam heating)....	1,200.00	
Shafting, Pullies and Belting.....	1,750.00	
Setting up machinery.....	1,000,00	
Total Machinery.....		$13,550.00
Kilns—		
1 Calcining Kiln, complete.....	$ 2,00,000	
12 Brick Kilns, at $900 (16 ft. diam. x10 ft. high).....	10,800.00	
8 Stacks, at $250.....	2,000.00	
Total.....		14,800.00

SUMMARY.

Mason Work	$ 5,620.20
Wood Work	$ 7,870.00
Machinery	13,550.00
Kilns	14,800.00
Incidentals	3 159.80
Total cost	$45,000.00

(Signed.) H. A. WHEELER,
Mining Engineer.
ST. LOUIS, FEBRUARY 27, 1889,

COST OF WORKING THE POT CLAY.

NOTE.—As the loss in the careful hand picking, which all pot clay must undergo, (to secure the highest purity), is taken at the high figure of 50 per cent, it will require 2 tons raw clay to make 1 ton of picked clay,

Mining 2 tons at 40 cents per ton	$0.80
Hauling 2 tons at 10c (to the factory)	0.20
Picking 2 tons at $1.00	2.00
Barreling 1 ton	1.25
Hauling to Wabash R. R. at Baden	0.50
Incidentals	0.25
Total working expenses, per ton	$5.00

(Signed) H. A. WHEELER,
Mining Engineer.
ST. LOUIS, FEBRUARY 27, 1889.

COST OF WORKING THE WASH-POT CLAY.

As the loss in washing is 16 per cent, it will take 1 1-6 tons raw clay to make one ton of washed clay.

Mining 1 1-6 tons at 40 cents, complete expense	$ 0.47
Hauling 1 1-6 tons at 10 cents, (to the factory)	0.12
Washing 1 1-6 tons $8.58 (see below)	10.00
Barrelling	1.25
Shipping to Wabash R. R. at Baden	0.50
Incidentals	0.25
Total working expenses per ton	$12.59

COST OF WASHING CLAY WITH A 6 TON PLANT.

EXPENSES PER DAY.

Labor per day (see page 19)	$28.25
* 4 Tons coal at $2.00 per ton	8.00
Oil, Waste and Packing	0.50
Repairs and Renewals	5.00
Interest on $20,000 plant at 6 per cent for 1-300 year	4.00
Interest on $7,500 working capital at 8 per cent for 1-300 year	2.00
Carrying $15,000 insurance at 2 per ct. for 1-300 year	1.00
Interest on 1800 tons clay, weathering, 12 months stock, at 50 cents per ton, delivered, at 8 per ct.	0.24
Incidentals	2.50
Total daily expenses	$51.49

Daily capacity of plant, 6 tons.

Then $51.49 ÷ 6=$8.58 per ton total cost of washing.

* Coal was mined on the Sattler tract from a 22 inch seam for $1.50 a ton for labor.

The Labor Account per day is as follows:

1 Engineer	$3.00
1 Fireman	2.00
2 Pressmen, at $2.00	4.00
2 Brick Machine Hands, at $2.00	4.00
5 Wheelers and Laborers, at $1.50	7.50
1 Bagman	2.25
1 Watchman	1.50
1 Foreman	4.00
Total daily labor expenses	$28.25

(Signed.) H. A. WHEELER,
Mining Engineer.
St. Louis, February 27, 1889.

* * * * *

TESTIMONY OF GEORGE SATTLER.

TESTIFIED that he had leased the land on the East side of the Columbia Bottom Road, which the city desires for its conduit, from Albert M. Meints for the past 16 years. That he had been making paving brick for the past 14 years.

Testified that he made the paving brick that the Commissioners had seen in use in the North gate-way of the freight yard of the Missouri Pacific Railroad depot on Seventh street, in 1881, when he made about 10,000 paving brick. Said that these brick were made from the clay mined from the West side of the Columbia Bottom Road, but which he stated was the same in quality as that from the East side of the road on the land desired by the city. Stated that he had made these paving brick like ordinary brick in a Penfield brick-machine. That 90 per cent of these 10,000 brick were defective. That the best of the lot were picked out and laid on Second street on Oct. 31, 1881, where they remained in use under heavy traffic for 3 years, when they had to be taken up to make way for granite, with which the entire street was being paved. That these same brick were relaid in front of the Mechanic's bank, where they remained in use until the city contractors again had them taken up to permit paving the street with granite. That these same brick were again laid in the North gate-way of the Missouri Pacific Railroad freight yard on Seventh street, on Nov. 20, 1883, where they remained in constant use under heavy traffic until last January, 1889, when they were torn up to make way for granite.

[Specimens of these brick, after their seven years hard service, were shown to the Commissioners by Mr. Sattler, to call their attention to the very moderate wear they exhibited, about 3-32 of an inch, after such long service under heavy freight traffic.]

Testified that some paving brick had been made by an expert, Mr. Wassall, that contained 1-5 shale, which were

poor brick, as they cracked badly and discouraged the backers of his paving brick.

Testified that he had experimented with 50 tons of clay from the Meints land for 21 months at the factory of Thos. Coffin & Co., and had found out how to make his paving brick successfully; for he put 4,100 paving brick in a kiln and did not have one defective brick in the entire lot after burning; that it was part of that lot which the Commissioners had personally examined at the factory of Thos. Coffin & Co. [a pile of about 2000 perfectly sound brick.]

Testified that he now heats his clay, before tempering and moulding, which prevents the cracking that formerly made the manufacture of his brick a practical failure.

Stated that the cost of making street paving brick with about a $36,000 plant was $8.00 a square of 100 square feet, the brick being 4x9x5 inches, or twice the size of a fire brick. That with a capital of $100,000 he could deliver them in the city at a profit of $2.00 for $12.50 a square. Stated that his paving brick need a less expensive foundation than granite paving blocks, as they could be laid on a sand bed. That he would repave the macadamized streets with his paving brick by first throwing back the macadam, as a foundation, putting on a top-dressing of sand for a bed, and would then lay his brick on the sand and would not go to the expense of a homogeneous concrete foundation, as with granite. Stated that a lot of his brick were laid on Fifth street, between the car tracks, in mud; that after a years service, on taking them up, they were found to be resting on a solid foundation and had worn well.

Testified that two reasons had prevented him from going into the market as a manufacturer of paving brick: Ist, Want of knowledge how to successfully make the brick, and 2nd, Want of money. That he has now overcome the first obstacle, as he found out, about a year ago, that by calcining or heating the clay he could prevent the heavy loss

from cracking that formerly made the brick a failure, and is now perfecting a mechanical furnace for effecting this calcining.

[Mr. Jewett here submitted a patent, granted by the U. S. Patent office on Jan. 1, 1889. No. 395,590, to George Sattler, for an improved process for making brick by first calcining or heating the clay, whereby the danger of cracking from excessive shrinkage in drying and burning is avoided.]

Testified that the clays on the East and West sides of of the Columbia Bottom Road of the Meints land are the same in quality. That he knows of no similar clay elsewhere as the paving brick clay on the Meints land, though he has examined clays from all over the country and especially from around St. Louis.

Stated that he had a landing at the foot of the Meints property, on the Mississippi river, and that there is deep water there, as the channel runs along the West bank of the river; that he has shipped clay from there to Carondelet and La Salle, Ill.

* * * * *

Testified that Mr. Meints has 26 acres with clay on it, as proved by shafts, and that he (Sattler) leases 36⅓ acres more, from other parties, that contain clay.

Testified that there are six shafts sunk on the Meints land an the West side of the Columbia Bottom Road, that cover a distance of 700 to 800 feet in a North and South direction and about 700 or 800 feet in an East and West direction, in which the same clays are found in all the shafts. That these shafts show an average of 25 feet of fire clay, of of which 4 feet is pot clay and 21 feet is paving brick clay. That there is a 22 inch seam of coal over the fire-clay; that there is 6 or 7 feet of black slate over the coal, with shales overlying the slate, then a bed of gravel and then a capping of common brick clay. That the 61 acres of the

Meints land on the West side of the Columbia Bottom Road contains, according to his measurements:—

1,936,000 cubic yards of paying brick clay.
290,400 cubic yards superior fire clay.
193,600 cubic yards pot clay.
177,468 cubic yards coal.

That there would be no trouble whatever in working this coal and these clays, which would be faciliated by a ravine running across the land. That the shales could be worked up with the clays into common brick and stock brick. That the entire Meints land is worth $500,000 to a company that could afford to build an adequate plant to work up the clays. Testified that he hopes to have works running on the premises within 12 months.

* * * * *

TESTIMONY OF WM. GLASGOW, JR.

TESTIFIED that he had signed a report made on the Sattler paving brick 7 or 8 years ago. That Mr. Sattler had brought brick to him that looked like good street paving brick. That these brick were tested by putting some down on the street, and others were tested under a machine at the water works, which corresponded to a cart constantly running over them. That some of Sterling's hydraulic press brick and some Cheltenham brick were also tried with the Sattler brick for comparison. That the machine was run over the brick for 10 days, making about 150,000 passages over the brick, which was regarded as being equivalent to 35 years heavy service in the street. That he measured the brick after having thus tested them and found that Sattler's brick had worn less than the others. That the Board of Improvements were requested to make an official test of the brick, but they failed to do so, as they claimed the machine was injuring the building. That the results of his measurements of the wear of the brick are given in the printed report on the Sattler paving brick.

Testified that he saw the making and burning of the first lot of Sattler paving brick, which were made at experimental works built on the Meints land and from clay that was taken from a shaft about 100 yards West of the Columbia Bottom Road. That these first brick were laid at Second and Pine streets, where after about a years use they had to be removed to permit paving the street with granite; were relaid in front of the Mechanics' Bank, where they staid for about 2 years, when they again had to make way for the granite, and were relaid at the Seventh street depot of the Missouri Pacifie R. R., where he last saw them in use about 6 or 7 months ago, after 7 years service, when they were in good condition. That $5,000 were raised by subscription, to which he was one of the subscribers, to make further tests of the Sattler paving brick. That as Mr. Sattler was not a

brick maker, an expert, Mr. Wassall, of Cheltenham, was engaged to make the brick. That Mr. Wassall made his brick of a mixture of clays and shale which spoilt the brick, so that when some were laid at the St. Louis Bridge entrance at Third street on a poor foundation, they did not turn out well. That on account of this failure of Wassal's brick the formation of a company was abandoned.

Testified that he thinks the first lot of Sattler's paving brick are better than granite. That he has seen the last lot of 4,100 brick made by Sattler and thinks that they are even better than the first lot. That he thinks the manufacture of Sattler paving brick would be a profitable business. That streets could be paved with Sattler paving brick laid on a good foundation for $30 a square, and on a sand foundation for $13 a square. That the bricks could be turned over after one face is worn out, or could be re-used on alleys, where the travel would be lighter.

Testified that he is not an expert on clays; and therefore would say nothing about the clays.

TESTIMONY OF MATTHIAS KONCEN,

a Street Paving Contractor.

TESTIFIED that he is a street paver. That he laid the Sattler street paving brick at the Boatman's Bank at Second and Pine streets; that on their being torn up to lay a water-pipe, he relaid them there again. That he relaid them in front of the Mechanics' Bank, when they had to make way for granite; but he did not lay them at the Seventh street depot. Saw these brick in use at the Seventh street depot about a year ago, when some were in good condition and some were in bad condition; the poor ones were next to the sidewalk, where they were depressed and injured by having a poor foundation.

Thinks that the Sattler street paving brick, if properly made, would make an excellent pavement and wear well, as those that had come under his observation had not worn away more than ¼ inch, and that they did not spall or "cobble" easily *i. e.* lose their edges and become round like a cobble-stone. That they would make a better roadway—more durable—than Nicholson or asphalt pavement. That he would prefer the *best* granite for the most durable pavement, but that Sattler's paving brick would wear as long as *common* red granite, which conduroys and wears into boulders. That inferior red granite would have worn more than the Sattler paving brick at the Seventh street depot under such heavy travel. Regards the Sattler paving brick as the best clay brick he has ever seen, and if he can make a uniform even grain brick, that it will wear longer and better than common granite. That the Sattler brick has grit and so keeps rough and does not get slick or like glass, like some blue granites, which are very durable but valueless for this reason. That the Sattler brick does not need such a good foundation as granite, as the joints set closer, so that it does not wear so fast on the edges and the dirt does not work out from between the blocks as with granite, with its

wide joints on account of its rough dressing. That he would lay the Sattler brick on a 4 inch bed of sand, though the city engineers would put a 6 inch bed of concrete under the sand. That he had laid some of Sattler's paving brick on Fifth and Pine, between the horse-car tracks on a sand and mud foundation, that had worn the best of all. Thinks that coal cinders would make an excellent foundation.

Testified that granite block cost him $28.00 to $30.00 per square of 100 square feet, delivered, and thinks that wood pavement is worth $36.00 a square, including curbing and foundation, laid. Does not know of any sales of the Sattler paving brick to the city or to any one else.

TESTIMONY OF STANISLAUS MITCHELL,

President of the Mitchell Clay Mfg. Co.

TESTIFIED that he has worked all his life in the red and fire brick business, and for the past 18 or 20 years in the fire brick business. That he has made paving brick for Mr. Sattler on two occasions from the clay said to have been taken from the Meints land, and made the paving brick the same way as fire brick. That he does not call the Sattler paving brick clay a true fire clay, but a bastard clay or a clay between a fire clay and potter's clay,

Testified that Sattler's paving brick clay is totally unlike any clay found at Cheltenham, nor does he know of any clay like it to be found elsewhere. That he makes drain pipe, tile and fire brick at his own works at Cheltenham, which are situated close to the Laclede Fire Brick Co.'s factory.

TESTIMONY OF RICHARD F. SMITH,

a Fire Brick Maker.

TESTIFIED that he is a brick maker and has been employed at Thos. Coffin & Co's for the past 4 years. That he was there when the last lot of 4,100 Sattler paving brick were made, and has seen them. That he regards the 4,100 lot of paving brick as being of an excellent quality. On being shown the sample of paving brick exhibited by Prof. Wheeler that were made from clay taken from the 60 foot strip desired by the city, he testified that they are essentially the same as the 4,100 lot of brick made from the West side clay. That the Sattler paving brick clay is unsurpassed for making paving brick. That he knows all the Missouri clays and says that none of them are like Sattler's paving brick clay. That he has worked for Christy in his pot clay mine and for Evans & Howard, and states that neither of them have any such clay as Sattler's paving brick clay.

TESTIMONY OF JOSEPH WINKLE,

Terra Cotta Manufacturer.

TESTIFIED that he has been in the clay and pottery business for 43 years, of which the first 12 years in Great Britain, and for the past 5 years has been making terra cotta ware at Cheltenham, Mo. That he has experimented a great deal with clays from all over the United States. That he has never mined clay, but has had occasion to examine clay mines almost yearly, and in one case had to do so twice every day.

Testified that he had examined Mr. Green's samples of kiln-burned clays from the 60 foot strip of the Meints land

that were taken from the No. 2 pit, and says that they show a poor quality of clays, while the sample of the top of the fire clay shows considerable lime. That he thinks the clay is of no value on the Meints land, and would give no more for the property than for its surface value. That he has never seen the Meints land. On being shown the little red bricks made by Prof. Wheeler from the "top-dirt," stated that they show they are made of clay, but of no better clay than any sub-soil clay such as is found all about St. Louis in great abundance.

On being shown some of the Sattler street paving brick from the Seventh street depot, he stated that they are good, hard, durable brick, and would wear well and make good friction. That if the Meints land contains clay that would make a brick like these that it is of some value for its clay. That the making of 4,000 paving brick like these is sufficient to prove the practicability of the process. That such brick (4x5x9) could not be made for $12.00 per 1000, but might be made for less than $20.00. That he could not definitely give the cost of manufacture, as this was constantly varying, as the Laclede Fire Brick Works, of which he was twice superintendent, have lowered the expense of making fire brick $6.00 per 1000 within the past 5 years.

Testified that he has made paving brick in Scotland that lasted over seven years. That he thinks he would make Sattler paving brick if he had the clay and thinks that street paving brick clay may be obtained in the Cheltenham district. Testified that he can not tell the quality of a clay by looking at it, and that it must be burned before the quality can be determined. That the principal thing in working clay goods is in the mode of treatment of the clay. That he makes his terra cotta ware of a mixture of 4 or 5 different clays that he gets at Cheltenham, of which there is an abundance about St. Louis.

* * * * *

TESTIMONY OF CAPT. WM. S. DIXON,

Superintendent of Thos. Coffin & Co's. Glass Pot and Fire Brick Factory.

TESTIFIED that he is a manufacturer of fire brick, glass pots, etc,; has been Superintendent of Thos. Coffin & Co's. factory, St. Louis, for the past 5 or 6 years, and has been in the fire brick and glass pot business ever since he was 13 years old. [Capt. Dixon looks to be a man considerably over 50 years of age.]

Testified that he knows the Meints land and has used clay mined from the Meints tract on the West side of the road. Stated that he had never seen such clay as the Sattler paving brick clay, though he has examined and worked clays from all parts of the United States, Stourbridge and other English clays, Coblenz and other German clays.

Stated that Mr. Sattler had had trouble at first in making paving brick,but that he has now learned how to make them; that he can now make them with as much success as ordinary fire brick, and that the paving brick can now be dried in the sun or wind. That he saw the making and burning of the 4,100 lot at Coffin & Co's. factory, and that Sattler's paving brick can be burned as easily as any fire brick, at no greater risk. That the cost of making up Sattler's clay into paving brick would be but little more than with ordinary fire clays, like the Cheltenham clay, when made into fire brick.

Testified that he made a glass pot of Sattler's pot clay in Pittsburgh, in 1876, using the raw, crude clay, that came from the West side of the Columbia Bottom Road, and that it made an excellent pot. That the market price of good pot clay is $13.00 to $14.00 a ton, and washed pot clay is $16.00 a ton. That the pot clay from the Meints land is of

very good quality, and only needs careful selection, without washing. That he uses some crude and some washed clay in making his pots at Coffin & Co's. factory that comes from his mine at Gratiot Station, on the St. L. & S. F. R. R., about 6 miles Southwest of St. Louis. Testified that there is no paving brick clay at Cheltenham, and that Cheltenham clays will not make a paving brick like Sattler's.

Stated that the Christy Fire-clay Co's. mine, and Thos. Coffin & Co's mine are the only producers of pot clay at present in the United States, and that the pot clay used in this country that does not come out of the above two mines is all imported, mostly from Germany. That he regards the Sattler or Meints pot clay as good in quality as Coffin & Co's., though he has not bought any more since 1876 as he has had no need of it. States there is a heavy importation of pot clay from abroad, as the Christy and Gratiot mines do not supply more than $\frac{1}{3}$ to $\frac{1}{2}$ of the demand. That the foreign pot clays are not as good as the Christy and Gratiot pot clays, as they will not stand the heat so well, and are cheaper, selling for $12.50 per ton in New York. That the tariff on pot clay amounts to about $2.50 a ton, and was $3.00 higher before the lowering of the duty in 1883. That he ships his pot clay all over the country, in blocks, barrels and bulk. States that he has plenty of pot clay in his Gratiot mine, and that Christy has plenty; but knows that Evans & Howard, and Parker & Russell buy fire brick clays and would undoubtedly buy Sattler's clay if they could get it cheap enough. Thinks that the Cheltenham fire clay will finally give out, and states that the Christy pot clay is not as good as at first. Thinks that the early Sattler street paving brick have made a good record and stood the test of wear very well; knows that a large amount of money will be needed to put the Sattler paving brick into the market, and that their market value has still to be determined. Has seen the brick at the Seventh street depot and calls them excel-

lent paving brick, and regards the last lot of 4100 paving brick as better than these.

* * * * *

Testified that the expense of making 4x5x9 Sattler paving brick, with a proper plant, costing about $40,000, and with $50,000 or $60,000 working capital, would not exceed 2 cents each or $20 per 1000 or $8.00 per square; that he is quite positive that the cost would not exceed $20 per 1000. That he thinks that the last 4,100 lot made by Mr. Sattler are better than the first batch made by him, and that the test samples of paving brick exhibited by Prof. Wheeler are as good in quality as the 4,100 lot.

That if a railroad is built past the Meints land that the transportation facilities would be about as good as any enjoyed by the St. Louis fire brick makers. That the clay on the 60 foot strip on the East side of the road is as good as the West side clay.

TESTIMONY OF ANTHONY ITTNER,

Brick Manufacturer.

TESTIFIED that he has been a maker of building and sidewalk brick all his life. That he had been a subscriber to the Sattler brick fund, and that it was the intention to form a company to manufacture them if the second experiment had been successful. That as Mr. Sattler was not a brick maker, an expert was hired by the subscribers to the second fund to make the brick, but that they were not a success. That the failure of the second lot of brick made by the expert, Mr. Wassall, was thought to be due to having mixed some of the overlying shales with the clay, while Mr. Sattler had only used clay from one strata in the first lot, and this failure discouraged the subscribers. That he would now go into the business of manufacturing Sattler paving brick if he had the cash and there was sufficient financial backing to the enterprise.

Testified that he thinks the Sattler paving brick that were laid on Second Street would last 12 or 14 years, and on reversing the brick, that the bottom side would stand 10 or 12 years more service before the body of the brick would be used up. That he thinks the Sattler street paving brick are superior to granite; for while they are not so durable, it is not so noisy, it is smoother to drive over, and when one side of the brick is worn, it can be reversed and the other face used, which cannot be done with granite on account of the wedge-shaped character of the blocks. That he would prefer the Sattler street paving brick to granite for any kind of service, whether for light or heavy traffic, and he regards the brick as being very valuable. That he thinks the brick of the last 4,100 lot made by Sattler are fully as good as the Second street or Seventh street depot lot of brick, as near as he can judge by inspection. That he has seen no street paving brick used in St. Louis except one lot laid in Pine street, made by the Laclede Fire Brick Co. for another party. That he thinks the Sattler paving brick should have

a good solid foundation like any other paving material; that he would lay the brick in ½ inch bed of cement on a concrete foundation, which would then make the best of pavements.

Testified that brick could be shipped from the Meints land by river as favorably as from the city levee; but that boat transportation is hard on brick, as on account of the rough handling they get chipped. That he has shipped stock brick to St. Paul by river, but prefers to do it by rail, as they are injured less in the handling. That he ships his stock brick to St. Paul and the Southern States. That his brick-yards are in the Southwestern part of the city, about 2 or 2½ miles from the Court House. That he sells his "stock" or "face" or "paving" brick for $18.00 per 1000 for the best quality and $12.00 for the second quality, *f. o. b.* or delivered in the city.

* * * * *

On being shown the little red bricks made by Prof. Wheeler from what Mr. Green called the "top dirt", he said that they were not made from dirt, but from a good building brick clay, and that it would make a good strong, durable house brick. That if this "top dirt" was river deposits, it probably would not make a press brick, as it would not burn red enough, but can not state positively. Thought there was clay on the Meints land that would make a press-brick. That the main difference between common red brick and face brick was in the method of making rather than in the quality of the clay, provided that it burned to a good color. Does not think it would pay to make common red brick on the Meints land at present, but it would pay to make face brick, to ship by river.

* * * * *

APPENDIX.

COST OF MAKING SATTLER PAVING BRICK.

An estimate by WM. WASSALL, formerly Superintendent of the Missouri Fire Clay Co., for 9x4x5 inch brick. This estimate was made by Mr. Wassall in 1884, but as he could not appear before the Commissioners, to personally present these figures, this evidence as to cost of their manufacture by the man who superintended the making of several thousand Sattler street paving brick for the Sattler Experimental Committee *was not presented to the Commissioners.* It is herewith appended as bearing directly on the subject.

COST OF 1000 9x4x5 BRICKS.

6 tons Paving Brick Clay at 40⅓ cents per ton	$ 2.42
2 tons Top Clay at 25 cents per ton	.50
Grading, Tempering and Moulding	3.20
Coal for Engine	1.00
Coal for Drying	1.00
Coal for Burning	4.00
Setting, Burning and Drawing	3.20
Total cost per 1000	$15.32

As 400 brick will pave a square, the cost per square for brick will be $6.13.

COMMISSIONERS' REPORT

of Case No. 78801,

ST. LOUIS CIRCUIT COURT NO. 3.

THE CITY OF ST. LOUIS
vs.
ALBERT M. MEINTS, et al.

NOTE.—The descriptions of the property, appointment of the Commissioners, and other matters not revalent to the clays or the value of the property are omitted, and the *italics are not those of the Commissioners.*

* * * * * * "Evidence is offered by both parties in the case bearing upon the surface value for agricultural and other purposes of the land which these proceedings seek to

condemn, and further evidence is offered by defendant relating to the value of certain clays underlying the surface of said land. *It appears in evidence* that the thickness of said clay bed is twenty-five feet more or less, consisting of various layers or strata designated, according to the uses for which they are adapted, as tile clay, paving brick clay, washed pot clay, and natural pot clay, and further *that the beds of paving brick and washed pot clays, if taken together and properly worked by known and practicable processes, can be manufactured into valuable paving brick suitable for use as such and at a good profit.* It is claimed by defendant that the bed of clay aforesaid underlies the greater part if not the whole of the tract of sixty-one acres more or less, situated on the West side of the Columbia Bottom Road, and further that this same bed of clay has been found by sinking pits on the West end of the tract, already described as situated East of the Columbia Bottom Road, that is under the strip of land which these proceedings seek to condemn. Defendant is unable to state the extent to which said bed of clay underlies said tract on the East side of the Columbia Bottom Road, but is of opinion from characteristics of the surface of said tract, viewed in the light of geological theories, that said clay underlies the West end of said tract for a width of two hundred and fifty to three hundred feet East from the Columbia Bottom Road, is more favorably situated for economical mining of aforesaid underlying clay and for manufacturing it into the paving brick for which he claims said clay is adapted.

We the undersigned commissioners, having carefully examined the land which these proceedings are intended to condemn in the light of afore-mentioned evidence and all the testimony presented, are of the opinion:

That in the appropriation and condemnation of the real estate sought to be taken for the purposes set forth in the petition herein, the land of the defendant is in no way divided

or cut in two parts, but only the West end is sought to be taken from the tract afore-mentioned as situated on the East of the Columbia Bottom Road.

That the successful establishment of the business of manufacturing paving brick from the clay already mentioned as underlying defendant's land *is too remote in the future to have any direct bearing upon the valuation of the land* under these condemnation proceedings.

That the said clay underlying the aforesaid tract on the East side of the Columbia Bottom Road and of which the land these proceedings are intended to condemn forms the West end is too uncertain in extent and quantity, and the natural conditions and relations are too unfavorable to make it desirable to mine and use *in view of the more reliable quantity and assured conditions for the utilization of the said clay underlying the aforementioned tract on the West side* of the Columbia Bottom Road.

That, while the tract on the East side of said road is more favorably situated and adapted for the erection and operation of any factory or works that may be established for the business of manufacturing paving brick, the defendant or others engaged in said manufacture will have the right of way across the Columbia Bottom road, and the line of Conduit, which it is intended to establish on the land which that under these condemnatian proceedings forms a part.

And further that in assessing the value of said land under the condemnation proceedings it it our duty as Commissioners to determine *not what profit might be made in the future* from said land, under conditions that may be developed for the utilization of any material known to exist in or to underlie such land, but with a knowledge of the occurence and use of such material and of the surface what is a full and fair valuation for the land.

In view of these considerations a unanimous decision has been reached, fixing the value of the land which these proceedings seek to condemn. And said Commissioners do assess against the said City of St. Louis, plaintiff, and in favor of defendant, the owner of said property above specifically described, the sum of Six Hundred and Fifty Dollars as damages sustained by said owner by reason of the appropriation and condemnation by said City of the said property for the purposes mentioned in said petition. * * *

All of which is respectfully submitted, this first day of May, 1889.

WILLIAM. B. POTTER,
LEWIS ROSENBAUM, } COMMISSIONERS.
JNO. C. LULLMAN,

Subscribed and sworn to before me this first day of May 1889.

{ SEAL. }

PHILIP H. ZEPP,
CLERK CIRCUIT COURT.